CHAPTER 57

IMS Rx, Diameter, and IMS Rf

The Cisco Unified Border Element (SP Edition) supports IP Multimedia Subsystem (IMS) Rx interfaces, Diameter protocol, and IMS Rf interfaces.

An IMS Rx is a Third Generation Partnership Project (3GPP) interface that runs between an application function and a Policy Charging and Rules Function (PCRF) in a 3GPP architecture.

The Diameter is an Authentication Authorization Accounting (AAA) protocol and is an enhanced version of the RADIUS (Remote Authentication Dial-In User Service) protocol.

An IMS Rf is an interface that runs between Charging Trigger Function (CTF) and Charging Data Function (CDF) in a 3GPP architecture.

Feature History for IMS Rx, Diameter, and IMS Rf

Release	Modification
Cisco IOS XE Release 3.1S	• The IMS Rx Interfaces feature was introduced. • The Diameter feature was introduced.
Cisco IOS XE Release 3.7S	The IMS Rf Billing Interface feature was introduced.

Contents

Information About IMS Rx Interfaces

An IMS Rx interface is a 3GPP interface that runs between an application function and a Policy Charging and Rules Function (PCRF) in a 3GPP architecture. In this case, SBC is the application function.

SBC uses the Rx interface to communicate with the PCRF during call initiation and renegotiation to ensure that a call conforms to policy. SBC uses the Rx interface during registration to learn access network information.

The PCRF performs the following functions for SBC via an IMS Rx interface:

- Confirms that call media requests conform to the appropriate policy.
- Opens gates or pinholes in the media route, and specifies the appropriate QoS.
- Requests per-flow charging information when needed.
- Informs SBC of media-plane events.

An IMS Rx interface can be configured as a pure Rx environment or as a mixed Rx and media resource environment in unified SBC.

Features Supported

SBC can be deployed as the application function connecting to a PCRF via an Rx interface, in a mobile network, under an IMS or non-IMS environment. SBC supports the following requirements for these environments:

- Support for precondition call flows with Rx
- Support for late-INVITE and PRACK with Rx
- SIP late and early interworking in combination with Rx
- SIP PRACK and non-PRACK interworking in combination with Rx
- Support for session binding on registration
- SBC does not add any IMS-specific SIP headers to requests or responses in non-IMS environment, and does not add P-Charging-Vector or P-Access-Network-Info information
- SBC can also use an Rx interface to query a policy server to perform admission control for requests from subscribers on an access network in non-IMS environments.

Restrictions

- SBC does not provide preferred or alternate routes for SIP or DNS interfaces.
- SBC does not support use of Rx in combination with local call transfers.
- Lawful Intercept of media for calls using Rx is not possible.
- SBC does not support Packet Cable billing on Rx interfaces.

Call Failures

If the PCRF fails to respond to a request from SBC, SBC treats only the individual request as failed.

Only fully established calls are maintained during redundant switchovers. Calls in the process of being set up are dropped.

Configuration

- See the ?$paranum>Configuring IMS Rx? section on page 57-3 for the procedure for configuring an IMS Rx Interface.

- See the ?$paranum>Configuration Examples for Diameter Routing? section on page 57-14 for configuration examples of IMS Rx.

Configuring IMS Rx

This section describes the following procedures:

Configuring an IMS Rx Interface

Use the following procedure to configure an IMS Rx interface.

SUMMARY STEPS

1. **configure terminal**
2. **sbc** *sbc-name*
3. **sbe**
4. **adjacency sip** *adjacency-name*
5. **ims realm** *realm-name*
6. **ims rx**
7. **ims pani**
8. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 2	**sbc** *sbc-name* **Example:** `Router(config)# sbc MySBC`	Creates the SBC service on Cisco Unified Border Element (SP Edition) and enters into SBC configuration mode.
Step 3	**sbe** **Example:** `Router(config-sbc)# sbe`	Enters the mode of the signaling border element (SBE) function of the SBC.

	Command or Action	Purpose
Step 4	**adjacency sip** *adjacency-name* **Example:** `Router(config-sbc-sbe) adjacency sip A_1`	Enters the mode of an SBE SIP adjacency.
Step 5	**ims realm** *realm-name* **Example:** `Router(config-sbc-sbe-adj-sip)# ims realm Realm_1`	Configures an IMS realm for use by an IMS Rx interface.
Step 6	**ims rx** **Example:** `Router(config-sbc-sbe-adj-sip)# ims rx`	Configures an IMS Rx interface for access adjacency
Step 7	**ims pani** **Example:** `Router(config-sbc-sbe-adj-sip)# ims pani`	(Optional) Configures the P-Access-Network-Info (PANI) header process preference for the adjacency.
Step 8	**end** **Example:** `Router(config-sbc-sbe-enum-entry)# end`	Exits configuration mode and returns to privileged EXEC mode.

Configuring Media Service for IMS Rx

Use the following procedure to configure media service for IMS Rx.

SUMMARY STEPS

1. **configure terminal**
2. **sbc** *sbc-name*
3. **sbe**
4. **cac-policy-set** *policy-set-id*
5. **cac-table** *table-name*
6. **table-type policy-set**
7. **entry** *entry-id*
8. **ims media-service**
9. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 2	**sbc** *sbc-name* **Example:** `Router(config)# sbc SBC1`	Creates the SBC service on Cisco Unified Border Element (SP Edition) and enters into SBC configuration mode.
Step 3	**sbe** **Example:** `Router(config-sbc)# sbe`	Enters the mode of the signaling border element (SBE) function of the SBC.
Step 4	**cac-policy-set** *policy-set-id* **Example:** `Router(config-sbc-sbe)# cac-policy-set 1`	Enters the mode of CAC policy set configuration within an SBE entity, creating a new policy set if necessary. *policy-set-id*—Integer chosen by the user to identify the policy set. The range is 1 to 2147483647.
Step 5	**cac-table** *table-name* **Example:** `Router(config-sbc-sbe-cacpolicy)# cac-table testSecure`	Enters the mode for configuration of an admission control table (creating one if necessary) within the context of an SBE policy set. *table-name*—Name of the admission control table.
Step 6	**table-type policy-set** **Example:** `Router(config-sbc-sbe-cacpolicy-cactable)# table-type policy-set`	Configures a CAC table to allow the use of media resources and 3rd party transcoding resources as well as Rx resources the table type of a CAC table within the context of an SBE policy set.
Step 7	**entry** *entry-id* **Example:** `Router(config-sbc-sbe-cacpolicy-cactable)# entry 1`	Enters the mode to modify an entry in an admission control table. *entry-id*—Specifies the table entry.
Step 8	**ims media-service** **Example:** `Router(config-sbc-sbe-cacpolicy-cactable-entry)# ims media-service`	(Optional) Configures a CAC table to allow the use of media resources and third party transcoding resources as well as Rx resources.
Step 9	**end** **Example:** `Router(config-sbc-sbe-enum-entry)# end`	Exits configuration mode and returns to privileged EXEC mode.

Disabling Preliminary AAR Messages

Use the following procedure optionally to prevent preliminary AAR messages from being sent during an IMS Rx session.

SUMMARY STEPS

1. **configure terminal**
2. **sbc** *sbc-name*
3. **sbe**
4. **cac-policy-set** *policy-set-id*
5. **cac-table** *table-name*
6. **table-type policy-set**
7. **entry** *entry-id*
8. **ims rx preliminary-aar-forbid**
9. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 2	**sbc** *sbc-name* **Example:** `Router(config)# sbc SBC1`	Creates the SBC service on Cisco Unified Border Element (SP Edition) and enters into SBC configuration mode.
Step 3	**sbe** **Example:** `Router(config-sbc)# sbe`	Enters the mode of the signaling border element (SBE) function of the SBC.
Step 4	**cac-policy-set** *policy-set-id* **Example:** `Router(config-sbc-sbe)# cac-policy-set 1`	Enters the mode of CAC policy set configuration within an SBE entity, creating a new policy set if necessary. *policy-set-id*—Integer chosen by the user to identify the policy set. The range is 1 to 2147483647.
Step 5	**cac-table** *table-name* **Example:** `Router(config-sbc-sbe-cacpolicy)# cac-table testSecure`	Enters the mode for configuration of an admission control table (creating one if necessary) within the context of an SBE policy set. *table-name*—Name of the admission control table.

	Command or Action	Purpose
Step 6	**table-type policy-set** **Example:** `Router(config-sbc-sbe-cacpolicy-cactable)# table-type policy-set`	Configures a CAC table to allow the use of media resources and third party transcoding resources as well as Rx resources the table type of a CAC table within the context of an SBE policy set.
Step 7	**entry** *entry-id* **Example:** `Router(config-sbc-sbe-cacpolicy-cactable)# entry 1`	Enters the mode to modify an entry in an admission control table. *entry-id*—Specifies the table entry.
Step 8	**ims rx preliminary-aar-forbid** **Example:** `Router(config-sbc-sbe-cacpolicy-cactable-entry)# ims rx preliminary-aar-forbid`	Prevents preliminary AAR messages from being sent during an IMS Rx session.
Step 9	**end** **Example:** `Router(config-sbc-sbe-enum-entry)# end`	Exits configuration mode and returns to privileged EXEC mode.

Configuration Examples for IMS Rx

This section provides the following examples:

- Configuration Example for IMS Rx Interface, page 57-7
- Configuration Example for IMS Rx Media Service, page 57-7
- Configuration Example for Disabling Preliminary AAR Messages, page 57-8

Configuration Example for IMS Rx Interface

The following example shows how to configure an IMS Rx interface:

```
Router# configure terminal
Router(config)# sbc mySBC
Router(config-sbc)# sbe
Router(config-sbc-sbe)# adjacency sip A_1
Router(config-sbc-sbe-adj-sip)# ims realm Realm_1
Router(config-sbc-sbe-adj-sip)# ims rx
Router(config-sbc-sbe-adj-sip)# ims pani
Router(config-sbc-sbe-adj-sip)# end
```

Configuration Example for IMS Rx Media Service

The following example shows how to configure media service for IMS Rx:

```
Router# configure terminal
Router(config)# sbc MySBC
Router(config-sbc)# sbe
```

```
Router(config-sbc-sbe)# cac-policy-set 1
Router(config-sbc-sbe-cacpolicy)# cac-table my_table
Router(config-sbc-sbe-cacpolicy-cactable)# table-type policy-set
Router(config-sbc-sbe-cacpolicy-cactable)# entry 1
Router(config-sbc-sbe-cacpolicy-cactable-entry)# ims media-service
Router(config-sbc-sbe-cacpolicy-cactable-entry)# end
```

Configuration Example for Disabling Preliminary AAR Messages

The following example shows how to prevent preliminary AAR messages from being sent during an IMS Rx session (optional):

```
Router# configure terminal
Router(config)# sbc MySBC
Router(config-sbc)# sbe
Router(config-sbc-sbe)# cac-policy-set 1
Router(config-sbc-sbe-cacpolicy)# cac-table my_table
Router(config-sbc-sbe-cacpolicy-cactable)# table-type policy-set
Router(config-sbc-sbe-cacpolicy-cactable)# entry 1
Router(config-sbc-sbe-cacpolicy-cactable-entry)# ims rx preliminary-aar-forbid
Router(config-sbc-sbe-cacpolicy-cactable-entry)# end
```

Information About the Diameter Protocol in the SBC

Diameter is an Authentication Authorization Accounting (AAA) protocol and is an enhanced version of the RADIUS (Remote Authentication Dial-In User Service) protocol. Diameter is the protocol of choice for the next generation IMS network developed by 3GPP.

When the Diameter protocol is implemented on a network, the Policy Charging and Rules Function (PCRF) acts as the Diameter server and the Application Function (AF), in our case SBC, acts as the Diameter client. SBC performs the functions of an IMS Rx Diameter client application and handles policy information and media reservations at the border of an access network.

SBC Diameter provides users with the option of configuring of either of two types of routing:

- Host-based routing
- Realm-based routing where multiple peers can be configured

Interfaces are referred as reference points in IMS. Reference points are named using unique acronyms, such as Rx (receiving reference point).

Features Supported

The following features are supported by SBC Diameter:

- SBC Diameter runs over TCP.
- SBC Diameter uses IPv4 addressing only.
- SBC Diameter supports IP Security Protocol (IPSEC).
- SBC Diameter supports multiple peers per realm.
- SBC Diameter supports redundancy switchover of Diameter peers as follows:
  - All Diameter messages are sent to the primary peer of the realm by default.
  - If the primary peer fails, Diameter switches to a secondary peer and retransmits all pending messages

Restrictions

SBC Diameter has the following restrictions:

- SBC Diameter does not replicate states or outstanding requests during redundancy switchovers. All states and outstanding requests are lost after a switchover from a failed active connection to a backup connection.
- SBC Diameter does not support IPv6 addressing.
- IPv6 is not supported.

Configuration

See the ?$paranum>Configuring SBC Diameter Routing? section on page 57-9 for the procedure for configuring the Diameter protocol in SBC.

See the ?$paranum>Configuration Examples for Diameter Routing? section on page 57-14 for configuration examples of the Diameter protocol in SBC.

Configuring SBC Diameter Routing

This section provides two routing configurations:

- Configuring Diameter Host-Based Routing, page 57-9
- Configuring Diameter Realm-Based Routing, page 57-11

Configuring Diameter Host-Based Routing

Use the following procedure to configure Diameter host-based routing. This procedure sets up an Rx adjacency first and then the Diameter host-based routing.

SUMMARY STEPS

1. **configure terminal**
2. **sbc** *sbc-name*
3. **sbe**
4. **adjacency sip** *adjacency-name*
5. **ims realm** *realm-name*
6. **ims rx pcrf** *pcrf-name*
7. **ims pani** [**received** | **rx** | **received rx** | **rx received**]
8. **exit**
9. **diameter**
10. **origin-realm** *realm-name*
11. **origin-host** *host-name*
12. **activate**
13. **end**
14. **show sbc** *sbc-name* **sbe diameter**

15. **show sbc** *sbc-name* **sbe diameter peers** *peer-name*
16. **show sbc** *sbc-name* **sbe diameter stats**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 2	**sbc** *sbc-name* **Example:** `Router(config)# sbc MySBC`	Creates the SBC service on Cisco Unified Border Element (SP Edition) and enters into SBC configuration mode.
Step 3	**sbe** **Example:** `Router(config-sbc)# sbe`	Enters the mode of the signaling border element (SBE) function of the SBC.
Step 4	**adjacency sip** *adjacency-name* **Example:** `Router(config-sbc-sbe) adjacency sip Adj_1`	Enters the mode of an SBE SIP adjacency.
Step 5	**ims realm** *realm-name* **Example:** `Router(config-sbc-sbe-adj-sip)#ims realm Rx_Realm_1`	Creates an IMS realm for the Rx.
Step 6	**ims rx pcrf** *pcrf-name* **Example:** `Router(config-sbc-sbe-adj-sip)# ims rx pcrf cisco.com`	Configures an IMS Rx reference point on this SIP adjacency and specifies the PCRF host where the Rx messages are routed.
Step 7	**ims pani** [**received** | **rx** | **received rx** | **rx received**] **Example:** `Router(config-sbc-sbe-adj-sip)# ims pani rx received`	(Optional) Configures the P-Access-Network-Info (PANI) header process preference for the adjacency.
Step 8	**exit** **Example:** `Router(config-sbc-sbe-enum)# exit`	Exits to the previous mode.
Step 9	**diameter** **Example:** `Router(config-sbc-sbe)# diameter`	Enters the Diameter configuration mode.

	Command or Action	Purpose
Step 10	**origin-realm** *realm-name* **Example:** `Router(config-sbc-sbe-diameter)# origin-realm cisco.com`	Configures the name of SBC's local realm for diameter messages.
Step 11	**origin-host** *host-name* **Example:** `Router(config-sbc-sbe-diameter)# origin-host sbc.cisco.com`	Configures the name of SBC's local host for diameter messages.
Step 12	**activate** **Example:** `Router(config-sbc-sbe-enum)# activate`	Activates Diameter host-based routing.
Step 13	**end** **Example:** `Router(config-sbc-sbe-enum-entry)# end`	Exits configuration mode and returns to privileged EXEC mode.
Step 14	**show sbc** *sbc-name* **sbe diameter** **Example:** `Router# show sbc MySBC sbe diameter`	Displays the local configuration information for Diameter.
Step 15	**show sbc** *sbc-name* **sbe diameter peers** *peer-name* **Example:** `Router# show sbc MySBC sbe diameter peers Peer1`	Displays the configuration information for IMS peers.
Step 16	**show sbc** *sbc-name* **sbe diameter stats** **Example:** `Router# show sbc MySBC sbe diameter stats`	Displays the transport statistics for an IMS peer.

Configuring Diameter Realm-Based Routing

Use the following procedure to configure Diameter realm-based routing.

SUMMARY STEPS

1. **configure terminal**
2. **sbc** *sbc-name*
3. **sbe**
4. **adjacency sip** *adjacency-name*
5. **ims realm** *realm-name*
6. **ims rx**
7. **exit**

8. **diameter**
9. **origin-realm** *realm-name*
10. **origin-host** *host-name*
11. **peer** *peer-name* **ipv4** *ipv4-address*
12. **peer** *peer-name* **ipv4** *ipv4-address*
13. **realm** *realm-name* [**app rx**] **peer** *peer-name* [**priority** *priority*]
14. **realm** *realm-name* [**app rx**] **peer** *peer-name* [**priority** *priority*]
15. **activate**
16. **end**
17. **show sbc** *sbc-name* **sbe diameter peers**
18. **show sbc** *sbc-name* **sbe diameter peers** *peer-name*
19. **show sbc** *sbc-name* **sbe diameter peers** *peer-name*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 2	**sbc** *sbc-name* **Example:** `Router(config)# sbc MySBC`	Creates the SBC service on Cisco Unified Border Element (SP Edition) and enters into SBC configuration mode.
Step 3	**sbe** **Example:** `Router(config-sbc)# sbe`	Enters the mode of the signaling border element (SBE) function of the SBC.
Step 4	**adjacency sip** *adjacency-name* **Example:** `Router(config-sbc-sbe) adjacency sip Adj_1`	Enters the mode of an SBE SIP adjacency.
Step 5	**ims realm** *realm-name* **Example:** `Router(config-sbc-sbe-adj-sip)#ims realm Rx_Realm_1`	Creates an IMS realm for the Rx.
Step 6	**ims rx** **Example:** `Router(config-sbc-sbe-adj-sip)# ims rx pcrf cisco.com`	Configures an IMS Rx reference point on this SIP adjacency.

	Command or Action	Purpose
Step 7	**exit** **Example:** `Router(config-sbc-sbe-enum)# exit`	Exits to the previous mode.
Step 8	**diameter** **Example:** `Router(config-sbc-sbe)# diameter`	Enters the Diameter configuration mode.
Step 9	**origin-realm** *realm-name* **Example:** `Router(config-sbc-sbe-diameter)# origin-realm cisco.com`	Configures the domain name of an IMS local realm.
Step 10	**origin-host** *host-name* **Example:** `Router(config-sbc-sbe-diameter)# origin-host sbc.cisco.com`	Configures the domain name of the local IMS host.
Step 11	**peer** *peer-name* **ipv4** *ipv4-address* **Example:** `Router(config-sbc-sbe-diameter)# peer peerA address ipv4 1.2.3.4`	Configures the name and IPv4 address of peerA.
Step 12	**peer** *peer-name* **ipv4** *ipv4-address* **Example:** `Router(config-sbc-sbe-diameter)# peer peerB address ipv4 1.2.3.5`	Configures the name and IPv4 address of peerB.
Step 13	**realm** *realm-name* [**app rx**] **peer** *peer-name* [**priority** *priority*] **Example:** `Router(config-sbc-sbe-diameter)# realm test.com app rx peer peerA`	Configures a peer and assign the peer to the realm.
Step 14	**realm** *realm-name* [**app rx**] **peer** *peer-name* [**priority** *priority*] **Example:** `Router(config-sbc-sbe-diameter)# realm test.com app rx peer peerB priority 10`	Configures another peer and assign the peer to the realm.
Step 15	**activate** **Example:** `Router(config-sbc-sbe-enum)# activate`	Activates Diameter realm-based routing.

	Command or Action	Purpose
Step 16	**end** **Example:** `Router(config-sbc-sbe-enum-entry)# end`	Exits configuration mode and returns to privileged EXEC mode.
Step 17	**show sbc** *sbc-name* **sbe diameter peers** **Example:** `Router# show sbc MySBC sbe diameter peers`	Displays the configuration information for all IMS peers.
Step 18	**show sbc** *sbc-name* **sbe diameter peers** *peer-name* **Example:** `Router# show sbc MySBC sbe diameter peers peerA`	Displays the configuration information for peerA.
Step 19	**show sbc** *sbc-name* **sbe diameter peers** *peer-name* **Example:** `Router# show sbc MySBC sbe diameter peers peerB`	Displays the configuration information for peerB.

Configuration Examples for Diameter Routing

This section provides the following examples:

- Configuration Example for Diameter Host-Based Routing, page 57-14
- Configuration Example for Diameter Realm-Based Routing, page 57-15

Configuration Example for Diameter Host-Based Routing

The following example shows how to configure Diameter host-based routing:

```
Router# configure terminal
Router(config)# sbc MySBC
Router(config-sbc)# sbe
Router(config-sbc-sbe) adjacency sip Adj_1
Router(config-sbc-sbe-adj-sip)# ims realm Rx_Realm_1
Router(config-sbc-sbe-adj-sip)# ims rx pcrf cisco.com
Router(config-sbc-sbe-adj-sip)# ims pani
Router(config-sbc-sbe-enum)# exit
Router(config-sbc-sbe)# diameter
Router(config-sbc-sbe-diameter)# origin-realm cisco.com
Router(config-sbc-sbe-diameter)# origin-host sbc.cisco.com
Router(config-sbc-sbe-enum)# activate
Router(config-sbc-sbe-enum-entry)# end
Router# show sbc MySBC sbe diameter
Router# show sbc MySBC sbe diameter peers Peer1
Router# show sbc MySBC sbe diameter stats
```

Configuration Example for Diameter Realm-Based Routing

The following example shows how to configure Diameter realm-based routing:

```
Router# configure terminal
Router(config)# sbc MySBC
Router(config-sbc)# sbe
Router(config-sbc-sbe) adjacency sip Adj_1
Router(config-sbc-sbe-adj-sip)# ims realm Rx_Realm_1
Router(config-sbc-sbe-adj-sip)# ims rx
Router(config-sbc-sbe-enum)# exit
Router(config-sbc-sbe)# diameter
Router(config-sbc-sbe-diameter)# origin-realm cisco.com
Router(config-sbc-sbe-diameter)# origin-host sbc.cisco.com
Router(config-sbc-sbe-diameter)# peer peerA address ipv4 1.2.3.4
Router(config-sbc-sbe-diameter)# peer peerB address ipv4 1.2.3.5
Router(config-sbc-sbe-diameter)# realm test.com app rx peer peerA
Router(config-sbc-sbe-diameter)# realm test.com app rx peer peerB priority 10
Router(config-sbc-sbe-enum)# activate
Router(config-sbc-sbe-enum-entry)# end
Router# show sbc MySBC sbe diameter peers
Router# show sbc MySBC sbe diameter peers peerA
Router# show sbc MySBC sbe diameter peers peerB
```

Note You can use the following, existing ASR1000 IPSEC functionality to provide secure Diameter protocol transport:

```
crypto isakmp policy 1
     encr aes
     authentication pre-share
     group 2

crypto isakmp key cisco123 address 0.0.0.0 0.0.0.0
crypto ipsec transform-set testcpoc esp-des esp-md5-hmac

crypto map diamap 10 ipsec-isakmp
     set peer 192.68.9.1
     set security-association lifetime kilobytes 536870912
     set transform-set testcpoc
     match address 199

access-list 199 permit ip 192.169.0.0 0.0.255.255 193.169.0.0 0.0.255.255

interface SBC01
 ip address 192.68.9.2 255.255.255.0
 crypto map diamap
```

Information About IMS Rf Billing Interfaces

The SBC supports Rf billing interfaces for SIP-to-SIP calls when operating as a Proxy Call Session Control Function (P-CSCF) and as an Interconnection Border Control Function (IBCF). The Charging Trigger Function (CTF) in the SBC uses an Rf billing interface to provide offline charging information to the billing domain in an IMS network. The Rf billing interface uses the Diameter protocol for sending billing information to the Charging Data Function (CDF). Offline charging is used for network services that are paid periodically, for example, a user may have a subscription for voice calls that is paid for on a monthly basis.

In IMS, billing information originates from the CTF. The CTF sends Accounting Request (ACR) messages containing billing information to the CDF, which collates this information into event-based and session-based Call Detail Record (CDR) files. The CDF then passes the files to the Charging Gateway Function (CGF), which is responsible for nonvolatile storage of the CDRs and for other functions such as, duplicate detection, error correction, and filtering. The CGF transfers the files to the billing domain for eventual account reconciliation. This final transfer is not time sensitive and can occur in batch mode. The billing domain uses the CDR to charge for the services used.

Offline Charging Events

For both event-based charging and session-based charging, the CTF supports the accounting state machine. The task of reporting offline charging events to the CDF is managed through a Diameter Accounting Request (ACR) message. The IMS Rf interface supports the ACR event types described in Table 57-1.

Table 57-1 IMS Rf ACR Event Types

Event Type	Description
START	Starts an accounting session.
INTERIM	Updates an accounting session.
STOP	Stops an accounting session.
EVENT	Indicates a one-time accounting event.

The START, INTERIM, and STOP event types are used for session-based charging. The EVENT type is used either for event-based charging or to indicate a failed attempt at establishing a session.

Rf Billing Error Handling

This section describes how the SBC handles the various types of Rf billing errors.

CDF Connection Failure

If the connection to the primary CDF is broken, the SBC sends the corresponding charging information to the secondary CDF (if present). If statically configured CDFs are used, the secondary CDF is the redundant peer of the next highest priority. If the dynamic CDF discovery task is performed, the secondary CDF is the address in the next ccf parameter in the P-Charging-Function-Address header. This process continues until a CDF responds, or there are no more CDFs. In the latter scenario, if an appropriate file system is available, the charging messages are stored in the nonvolatile memory until the CDF connection is restored. The connection to any of the available CDFs has no impact on the call setup.

No Reply from CDF

Because DIAMETER messages are transmitted over TCP or Stream Control Transmission Protocol (SCTP), a missing Accounting Answer response to an ACR must indicate that a connection is going down. In such a scenario, the procedure described in CDF Connection Failure section is followed.

Failure Response from CDF

The CDF can return any failure encountered while collecting billing information from the SBC, in the ACA message, even though the connection to the peer is active.

If the failure return code is DIAMETER_UNABLE_TO_DELIVER, this message is cached in nonvolatile memory and follows the procedure described in CDF Connection Failure section.

If the failure return code is any other value, a PD log is created to convey this information to the user, but no other action is taken.

Duplicate Detection

The SBC does not retransmit DIAMETER requests because the underlying TCP transport handles such requests. The CDF does not handle duplicate requests from the SBC.

CDF Detected Failure

If the SBC fails over, some Rf sessions may not be closed correctly, for example, when a call is set up during failover. The CDF must close CDRs pertaining to a particular session if it detects that ACRs are not received within a certain period.

Restrictions for IMS Rf Billing Interfaces

The IMS Rf Billing Interfaces feature has the following restrictions:

- The SBC does not support Rf billing for SIP-to-H.323 calls and H.323-to-H.323 calls.
- The SBC does not support Rf billing in a non-IMS network.
- The SBC does not supply the PS-Information attribute-value pairs (AVP) on its messages. Therefore, the SBC does not send the Cisco Gateway GPRS Support Node (GGSN)-Address AVP.
- The SBC does not supply the Third Generation Partnership Project (3GPP)-Charging-ID AVP.

Configuring an IMS Rf Billing Interface

Use the following procedure to configure an IMS Rf billing interface.

SUMMARY STEPS

1. **configure terminal**
2. **sbc** *sbc-name*
3. **sbe**
4. **adjacency sip** *adjacency-name*
5. **ims rf**
6. **ims realm** *realm-name*
7. **exit**

8. **billing**
9. **method 3gpp-rf**
10. **rf** *index*
11. **origin-host** *host-name*
12. **origin-realm** *realm-name*
13. **realm** *realm-name* **[usePCFAHeader | cdf** *cdf-name* **{FQDN** *FQDN-name* **| ipv4** *ipv4-address* **| vpn** *vpn-name***} [port** *port-number***] [priority** *priority-number***]]**
14. **attach**
15. **activate**
16. **end**
17. **show sbc** *sbc-name* **sbe adjacencies** *adjacency-name* **[authentication-realms | detail | peers]**
18. **show sbc** *sbc-name* **sbe billing instance [***instance-index***] [rf {realms [***realm-name* **current5mins]} | {cdfs [***cdf-name***]}]**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters the global configuration mode.
Step 2	**sbc** *sbc-name* **Example:** `Router(config)# sbc MySBC`	Creates the SBC service on the Cisco Unified Border Element (SP Edition) and enters the SBC configuration mode.
Step 3	**sbe** **Example:** `Router(config-sbc)# sbe`	Enters the mode of the signaling border element (SBE) function of the SBC.
Step 4	**adjacency sip** *adjacency-name* **Example:** `Router(config-sbc-sbe) adjacency sip A_1`	Enters the SBE SIP adjacency mode.
Step 5	**ims rf** **Example:** `Router(config-sbc-sbe-adj-sip)# ims rf`	Configures an IMS Rf interface for access adjacency.
Step 6	**ims realm** *realm-name* **Example:** `Router(config-sbc-sbe-adj-sip)# ims realm Realm_1`	Configures an IMS realm for use by an IMS Rf interface.

	Command or Action	Purpose
Step 7	**exit** **Example:** `Router(config-sbc-sbe-adj-sip)# exit`	Exits the SBE SIP adjacency mode.
Step 8	**billing** **Example:** `Router(config-sbc-sbe)# billing`	Configures the IMS Rf billing method.
Step 9	**method 3gpp-rf** **Example:** `Router(config-sbc-sbe-billing)# method 3gpp-rf`	Enables the 3GPP Rf billing method on the SBC.
Step 10	**rf** *index* **Example:** `Router(config-sbc-sbe-billing)# rf 0`	Creates a new Rf billing instance.
Step 11	**origin-host** *host-name* **Example:** `Router(config-sbc-sbe-billing-rf)# origin-host sbc.com`	Configures the domain name of an IMS local host. This value is displayed in the diameter Origin-Host AVP.
Step 12	**origin-realm** *realm-name* **Example:** `Router(config-sbc-sbe-billing-rf)# origin-realm cisco.com`	Configures the domain name of an IMS local realm. This value is displayed in the diameter Origin-Realm AVP.
Step 13	**realm** *realm-name* **[usePCFAHeader | cdf** *cdf-name* **{FQDN** *FQDN-name* **| ipv4** *ipv4-address* **| vpn** *vpn-name***} [port** *port-number***] [priority** *priority-number***]]** **Example:** `Router(config-sbc-sbe-billing-rf)# realm cisco.com cdf cdf1 ipv4 192.0.2.1 port 3688`	Enables dynamic CDF detection.
Step 14	**attach** **Example:** `Router(config-sbc-sbe-billing-rf)# attach`	Attaches an adjacency to an account on the SBE.
Step 15	**activate** **Example:** `Router(config-sbc-sbe-billing-rf)# activate`	Activates billing after it is configured.
Step 16	**end** **Example:** `Router(config-sbc-sbe-billing-rf)# end`	Exits the configuration mode and returns to the privileged EXEC mode.

	Command or Action	Purpose
Step 17	**show sbc** *sbc-name* **sbe adjacencies** *adjacency-name* **[authentication-realms | detail | peers]** **Example:** `Router# show sbc asr sbe adjacencies adj1 detail`	Displays whether IMS Rf is enabled or not.
Step 18	**show sbc** *sbc-name* **sbe billing instance [***instance-index***] [rf {realms [***realm-name* **current5mins]} | {cdfs [***cdf-name***]}]** **Example:** `Router# show sbc asr sbe billing instance 6 rf realms realm1 current5mins`	Displays the configuration of the Rf billing interface.

Configuration Example for IMS Rf Billing Interface

The following example shows how to configure the IMS Rf Billing Interface feature:

```
configure terminal
sbc MySBC
sbe
adjacency sip test
ims rf
ims realm cisco.com
billing
    method 3GPP-RF
    rf 0
        orig-host sbc.com
        orig-realm cisco.com
        rf 0 realm cisco.com cdf cdf1 ipv4 1.2.3.4 port 3688
        rf 0 realm cisco.com cdf cdf2 cdf.cisco.com priority 2
        attach
        activate
        end
```

The following is a sample output of the **show sbc sbe billing instance** command:

```
Router# show sbc asr sbe billing instance 1

    Billing Manager Information:
    Local IP address:            3.3.3.3
    LDR check time:              0:0
    Method                       rf
    Admin Status:                UP
    Operation Status:            UP

    Billing Methods
    Instance:                    1
    Type:                        3GPP-RF
    Transport Mechanism Status:  FAILED
    Active Calls Billed:         0
    Deact-mode:                  abort
    Admin Status:                UP
    Operation Status:            UP
    LDR check time:              24:0
    Origin Host:                 yfasr.open-ims.test
```

```
Origin Realm:                open-ims.test
```